Greco-Roman and Arabic Bronze Instruments and their Medico-Surgical Use.

by

S. Holth

GRECO-ROMAN AND ARABIC BRONZE INSTRUMENTS AND THEIR MEDICO-SURGICAL USE

BY

S. HOLTH

(WITH 4 PLATES, AND 5 FIGURES IN THE TEXT)

(VIDENSKAPSSELSKAPETS SKRIFTER. I. MAT.-NATURV. KLASSE 1919. No. 1)

UTGIT FOR FRIDTJOF NANSENS FOND

KRISTIANIA

I KOMMISSION HOS JACOB DYBWAD

1919

GRECO-ROMAN AND ARABIC BRONZE INSTRUMENTS AND THEIR MEDICO-SURGICAL USE

BY

S. HOLTH

(WITH 4 PLATES, AND 5 FIGURES IN THE TEXT)

(VIDENSKAPSSELSKAPETS SKRIFTER. I. MAT.-NATURV. KLASSE 1919. No. 1)

UTGIT FOR FRIDTJOF NANSENS FOND

KRISTIANIA
I KOMMISSION HOS JACOB DYBWAD
1919

Fremlagt i den mat.-naturv. klasses møte den 7de mars 1919

A. W. BRØGGERS BOKTRYKKERI A/S.

Since November last year a great many Greco-Roman and Palmyrene antiquities, collected in Syria and Palestine from 1872 to 1890 by the Russian baron Ustinov, who never published anything about his finds, have been sold in this city for English account. The first day I bought a bronze steelyard and a collection of surgical bronze instruments which seemed interesting from an historical point of view, many of them bearing an obvious likeness to some instruments from »Casa del Chirurgo« in Pompeji which I have seen in the »Museo Nazionale« in Naples.

I obtained no other information about the instruments then that, according to the sale catalogue, they were said to have come from Ascalon, an old port in Palestine 40 km. North of Gazah. From its history I would remind you that after Alexander the Great, under the Ptolemei and the Seleucidæ the town became a centre for Hellenistic culture in Palestine; it reached the height of its glory under the Roman Emperors, was conquered by the Arabs under the Kaliph Omar in 638 A. D. and was for a while in the hands of the Crusaders. In the thirteenth Century the fortifications were rased to the ground; since then it has been a town of ruins.

Besides in Ascalon Ustinov made collections in Gazah and Cæsarea as well to a great extent in Palmyra; several of our instruments are probably from this town. You remember that Palmyra under the Roman Emperors was a great city, a stapletown for the import of the Romans from China, India and Southern Arabia; after Aurelian's victory over Queen Zenobia in 272 A. D. it was reduced to a garrison town for the defense of the frontier and under the Kaliphs it did not play its ancient great part as a commercial centre. Even while it belonged to the Roman Empire the majority of the population and the ruling classes are said to have been Arab. Many of the names of the inscriptions on the tombs are Arab, in spite of their Aramaic and Greek letters. Since the 12th century, according to other sources the 14th century, also Palmyra has been a town of ruins.

The steelyard is of bronze, like all the medical instruments except one, which shall be mentioned below. The patina of some of the instruments is greenish, but on most of them of an even deep brownish black, with green dots in tiny hollows in the surface (some of these hollows can only be discovered under a magnifying glass).

In both cases the patina is not altered by washing in water or alcohol, and it is of a kind which can only be produced by the work of centuries and which no falsifiers have succeeded in imitating however great their efforts. If a tiny chip is cut out of some instruments through the patina layer, the shining surface of the cut is somewhat yellowish red. A fresh surface of fracture which I saw by an unvolontary break of a sound (Pl. II, 3) was greyish and granulary crystalline. Some instruments (Pl. I, 25—29, III, 13, 19, 20 and 23) must have been broken in antiquity as the granulary surface of the fractures are covered with the same kind of patina like the rest of the instruments. I have until now not been willing to sacrifice any of the instruments on a chemical analysis; according to Milne the bronze of Greco-Roman surgical instruments in cases analysed appeared a binary alloy of copper and tin with the alloy of tin nearly always about 7.5 %[1].

I will first speak about a Roman bronze steelyard which is drawn on Pl. I in size $\times\ ^{2}/_{3}$.

The *steelyard* consists of a quadrangular lever 34 cm. long, forming a balance with two unequal arms, provided with three crooked handles and with three different engraven scales of weight, probably one scale for each handle. The goods were probably placed in a dish hanging by cords attached near the end knob of the short arm. (See however foot note p. 7). The sliding weight was not found; in a Pompeian steelyard, which I have seen, the bronze sliding weight had the shape of a woman's head attached by a short chain, sliding on the long arm of the steelyard: this

[1] In connection with my lecture Professor J. Sebelien Aas, Norway gave some interesting information about the different composition of old bronzes. — The thought struck me that our bronzes might have another alloy than the alloy mentioned by Milne. Professor Sebelien has been kind enough to submit to a quantitative analysis as many samples of my instruments as I could procure. I have taken samples with pinchers or file; the colour of the fresh surfaces is different, copper red, yellowish red, reddish yellow, and yellow; but in Pl III, 19 it is grey and in 20 the broken surface resembles cast iron. The bronzes in these two latter instruments and in No. 21 contain much lead (13.44 %, 30.02 % and 6.85 %). No. 20 contains 10—12 % of Zinc, Iron and Cobalt — mainly Cobalt. No. 4 is pure copper, No. 6 contains 92.94 % copper and 5.30 % tin. The others contain copper from 74 % to 85 %, tin in most of them from 0.5 to 3.4 %, while the zinc alloy is great (between 11 % and 22 %). The detailed analyses by professor Sebelien will be found on the table p. 5. He will later publish a paper on the bronze question in the »Forhandlinger« or »Skrifter« of our Society

Quantitative analyses of bronzes in Dr. S. Holth's collection by Professor J. Sebelien (Aas, Norway).

	No. 1	No. 2	No. 3	No. 4	No. 6	No. 7	No. 8	No. 11	No. 13	No. 14	No. 18	No. 19	No. 20	No. 21	No. 24	Steel-yard
Tin	1.04	0.14	3.37	0	5.30	1.53	2.34	0.48	0.65	1.98	0.03	4.83	0 93	2.32	2.95	1.77
Lead	0.61	?	0.01	0	0.23	2.18	0.92	0.76	0.73	—	0.02	13.44	30.02	6.85	1.31	1.30
Copper	77.89	74.11	81.12	99.60	92.94	86.44	80.30	87.77	83.79	84.95	85.49	71.60	58.13	85.13	81.08	87.70
Zinc	17.38	21.79	13.00 (including some Nickel)	0	0.89	13.31	13.48	11.72	15 53	11.49	13.84	5.66	11.00 (incl. mainly Cobalt)	1.54	16.06	5.42
Iron	2.94	3.65		0	—	1.77	2.57		—	traces	traces	1.50		?	?	—
	99.86	99.69	97.50	99.60	99.36	99.23	99.61	100.73	100.68	98.42	99.38	95.93	100.08	95.93	101.40	—

steelyard had only two handles. The engraven lines, points, and letters of our three scales were nearly everywhere quite distinct but partly filled with produce of oxydation and of sand particles; on that account they were badly reproduced in the photos. In order to have all the marks distinctly on the negatives, and by this also on the lantern slides and on Pl. I. I have under a good light carefully marked everything on the instrument itself by a fine hair brush dipped in an emulsion of zincwhite in gum water (Pl. I, A, B and C). In the middle of the scale »A« are seen two oblique lines which join in the middle of the right side of a vertical division line by which is produced the shape of a »K«, probably the Greek letter »Kappa«, which here may signiy »twenty«. Besides the seventh division line to the left of this »K« is seen a sign which most resembles the Greek letter ξ and may in this case signify »sixty«. Close to the left of this sign a curved and an oblique line join in the right side of a vertical division line by which is produced an incomplete »R« which I dare not try to interpret; I must say the same about the oblique line, farthest to the right on the scale »A«. The scale »B« divided in twelve (Roman ?), show an »X« and beside it an oblique line; every sixth line between two long lines is marked with three dots (halving sign). On the scale »C« there is no letter; but near some lines are seen two or three dots and in one place six dots.

Mr. D. Isaachsen, the head of our institute for weights and measures, has kindly inspected the steelyard and made some trials with it. If the scale» B« divided into twelve is attached to the handle »B« and the smallest subdivisions are to represent ounces, he finds that the sliding weight must have weighed 466 grammes, and that on this scale there have been weighed up to 3.5 kg.; on the »C« scale up to 12.8 kg. »These limits of weight are evidently too high, for it could not have been possible to weigh such a great weight on the slender little steelyard«. Mr. Isaachsen finds, however, that the scale divided into twelve is attached far more naturally to the innermost handle »A«, which the weigher has then held in his right hand, having the long arm of the steelyard with the scale to his left. If the smallest division of the scale is to mark an ounce, the sliding weight will, by this arrangement, weigh 776 grammes and the limits of the weight will be 0.94 kg. to 2.57 kg. He finds also these figures too high[1]. Mr. Isaachsen therefore thinks it best to put off the calculation of the three scales till

[1] By adding the hanging apparatus Pl. I, d — and perhaps attached to it a counter-weight — on to the short arm, the sliding weight in the long arm will be diminished; see next note p. 7.

our University Library by his request has obtained some more detailed works about the weighing systems of Antiquity.

According to the above statements, the steelyard *may* have been suitable for a physician in the purchase of the drugs he needed for the preparation of remedies [1]. One of the Pompeian steelyards was found in »Casa del Chirurgo« together with surgical instruments. The physician of antiquity was his own apothecary. The *φαρμακοπῶλαι*, remedy dealers, and *ῥιζοτόμοι*, »root cutters« ↄ: herb gatherers, were railed at by Aristophanes as simple quacks.

The first real dispensary was established in 750 A. D. in Bagdad by the caliph El Mansur.

I will now give a survey of the 21 surgical instruments of Pl. II, III and IV (drawn in size $\times$ $^1/_1$) with short characteristics of their appearance and kind, mention the probable place and time of the finds, and give a sketch of the use of the instruments, as well as examine somewhat more carefully a few of them which are of special interest. Finally, I believe it may be of interest from an historical point of view to show that some instruments cannot have been used with certain treatments, where their use would have been natural to a surgeon of our day.

The eight first instruments given on Pl. II are certainly Greco-Roman,

---

[1] This surmise is highly strengthened by seeing the hanging apparatus Pl. I, D for the goods belonging to the steelyard which after my lecture I was fortunate enough to find among some unsold bronzes from the Ustinov collection; it has exactly the same kind of patina as the steelyard. As is seen in Pl. I, D a hook is placed in the groove nearest the final knob of the short weight arm; this hook carries by a ring and by clasps three flat sticks, each of which is provided with a clasp and hook by the lower end. A flat bowl with three holes or rings could, of course, be easily fastened to these hooks. Against this hypothesis, however, there is the fact that a quite similar hanging apparatus in the steelyard, which belonged to Cajus Firmius Severus, a Gallo-Roman oculist in Rheims, had also a top hook but only two hanging sticks each with its hook; no weighing bowl could adequately be fastened to only two such hooks (unless it was boat-shaped). The most likely hypothesis is consequently that these hooks were fastened direct to the goods which probably consisted of bundles of plant drugs, which the physician in Rheims as well as Ascalon bought from herb gatherers.

Since my lecture I have also acquired from the Ustinov collection thirty two different weights; the study of these weights will perhaps contribute to the explanation of the three weight scales in the steelyard. Some of them are signed with Greek letters — here evidently belonging to the Ionic or the Milesian cipher-alphabets; other weights have different polyedric forms. One larger weight is of lead, weighs 186 gram and is marked with a Phenician cipher 𐤍 𐤍 = 40); it has the shape of a four sided pyramid, it is pierced near the top and *may* have served for a sliding weight on a steelyard — or it *may* have been attached to the middle one of the three lower hooks in Pl. I D, by which the sliding weight can be made lighter and the weighing limits are lowered. This principle was used in the above mentioned small steelyard from Rheims (by a bullet just under the top hook).

9 is a modern model in steel of 7 and 8; 10 is a needle which certainly dates from Antiquity and is probably Greco-Roman.

It is characteristic of most of the medical instruments of Antiquity that they are made »double« that is both ends of the instrument are made for use. The advantage of this arrangement is a quick change of instrument; the principle has come down to our day, but from aseptic reasons it has been abandoned by the surgeon of the present day.

Pl. II, 1—4 and I, 25—29 are the Greek σπαθομήλη, spatula sound; the spatula is either flat (4 and 25—28), spoonshaped (2), gougeshaped (3 — not broken), willow leaf shaped, folded in an obtuse angle in its length and curved backwards (1); the sound ends have also different forms. In 5 the shaft has a broad and deep sharp spoon in one end and a conic pointed sound in the other end; on one side the instrument has a »millimeter« measure scale which I will mention below. Nr. 6 is a double sound whose lower end is stiletto shaped while the upper end has an »olive« knob; it ought to be noticed that the thicker ornamented part which indicates that there are two instruments joined in one, has an *excentric* position. I will discuss below Pl. II, 7 and 8. Pl. II 10, is a suture needle, biconvex in section with *2 lateral edges*

I believe it very probable that the statement of the sale catalogue is true, giving Ascalon as the finding place of these instruments; but it cannot be ascertained whether they are from the Hellenistic period of Ascalon or from the era of the Roman Empire in which — according to Th. Mommsen — the zinc bronzes came up; the shape of the instruments being of the same type for more than a thousand years — from Hippocrates down to the Byzantine era. Medical men of the Romans were as a rule Greeks or Egyptians with a Greek education.

As for the Pompeian instruments the age is given. Roman surgeons in Gaul in the second and third centuries A. D. had their instruments with them in their tombs as well as contemporary Roman Emperor coins. In the Ustinov collection of coins there are samples even from the Ptolemei down to Justinian, but they are in a special collection and there is no information that any of them have been found together with the surgical instruments.

Out of the fourteen instruments on Pl. III, number 15 is a modern spatula sound of glass which is used — sterilized — to put ointments into the palpebral fissure. Both Celsus and the Greek and the Arabic medical writers many times mention this use of their spatula sounds (Pl I, 25 and 26, Pl. II, I to 4, Pl. III, 11 to 14). Pl. III, 22 is a modern double glass rod equally used for application of eye ointments and corresponds com-

pletely to the double sounds Pl. III, 16—21, of which 19 and 20 were found broken near the central quadrangular handle. Also in instrument 23 the active end is broken; I have, however, good reasons for ascertaining the probable use of this instrument, about which I will speak below.

Pl. III, 24 is a spatula sound which stands isolated, being yellow and *lacking patina*. Though metallic zinc was unknown to the people of Antiquity round the Mediterrean, they understood how to make brass (ὀρείχαλκος, aurichalcum »gold copper«), by melting copper ores with the zinc ore »calamine stone«; among the hundreds of medical instruments from Pompeji 2 scalpel handles are of brass (25 % zinc, 75 % copper). So far Pl. III, 24 might certainly be an instrument from Antiquity, but the workmanship speaks against this supposition. Whereas the other instruments prove to be forged out of bronze in bars by a more or a less careful round hammering — No. 24 is hammered together by a stripe of brass plate; it is a rough piece of work and probably dates from a relatively modern time.

The bronze instruments in Pl. III differ in many things from the Greco-Roman ones in Pl. II. The *handle* in Pl. III, 23 is *four-sided*, the same is the case with the »middle handle«, placed *exactly in the centre*, of the double sounds 16—21; the *ornaments* are here short *straight grooves* made with a file. The corresponding *handles* of Greco-Roman instruments are *round*, the ornaments are transversal *ring grooves*, sometimes elaborately turned; there are also spiral ornaments. The *middle handle* is *excentrical* in all the Greco-Roman double instruments which I have seen in reality or in pictures (see Pl. II, 6).

It was, however, the spoon spatulas Pl. III, 11—14 which first attracted my attention; the spoon is only a round hollow stamped in the end of the spatula; the *twined ornaments* in 12—14 have a decidedly *oriental character* and are never seen on Greco-Roman instruments. And above all, in the spoon spatula 11 are seen some letters in basso-relievo which as far as I could see were Arabic; I thought they were most likely the name of the instrument maker. Such a one to my knowledge has been found only once before on a medical instrument from Antiquity, a toothed forceps from Pompeji. There is stamped an inscription which Védrènes read AGATGELVSF and interpreted as »Agathangelus fecit«; Milne reads the name somewhat differently.

I addressed myself to Mr. A. Fonahn, Ph. D., lecturer at the University in Kristiania, and asked him to inspect the inscription, which he very kindly did. He finds it is a Palmyrene man's name in Arabic transcription.

The name is also found in epitaphs in Palmyrene and in Greek letters; Mr. Fonahn's argumentation requires transcriptions in hebraic letters; his essay is printed in the same volume as my lecture. I will here only show the Arabic inscription magnified (Fig. 1) together with a few words inspired by Mr. Fonahn.

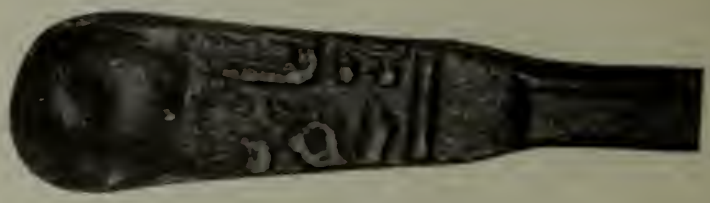


Fig. 1.
The Arabic inscription of the spoon spatula Pl. II. 11 enlarged × $^3/_1$.

We have here six Arabic consonants; there are no sign for vocalising and consequently no »hemza«; as well known the writing must be read from the right to the left. The consonants are as follows:

1. »Alif«; for several reasons, among others from the Greek transcription Ἀθηάχαβος, it must be inferred that the vocalisation is a short ă.
2. »tâ« = t; vowel: i or e, hardly a, not u.
3. »ʿain« is a diamond resting on a horizontal line; it reminds of one of the different Cufic shapes of this consonant. The vowel must be a short ă,
4. »kâf« = k; the following »alif« proves, that the vocalisation must be a long ā.
5. »alif«.
6. »bâ« = b.

In Roman transcription the name must be read »Atʿakāb.«

It might be supposed that a Palmyrene instrument maker had his business in Ascalon or that the instrument had come to this town in some other manner. The most natural surmise is, however, that the instrument was made and was found in Palmyra, from whence probably the greater part of the Ustinov collections came. The spoon spatulas Pl. III, 12–14 are evidently from the same workshop as No. 11. According to newer Arabists, in spite of their modern appearance the letters may be older than the Cufic letters. It is however most likely that the inscription dates from the epoch *after* the Mohammedan conquest; probably between the 7th and the 12th century A. D.

Mr. Fonahn says also that he has found in Melchior de Vogüé: »Syrie centrale. Inscriptions Sémitiques«, a Palmyrene inscription with the name

»Aʿthai«. Concerning this name it is said by Lidzbarski in his »Handbuch der Nord-Semitischen Epigraphik« that it is a hypokoristikon (pet name, diminutive) of Atiʿaqāb. It is very interesting that the name Aʿthai in the same epitaph, according to de Vogüé, is applied to »un médecin«. — It might be supposed that also our Atiʿakāb was been a physician and the owner of the instrument and that the name might be his — and not the maker's.

It cannot be decided whether the instruments Pl. III, 16—21 and 23—24 came from Palmyra or Ascalon.

Among the unsold bronzes in the Ustinov collection, I also found after my lecture the following instruments which are drawn on Pl. I, 25—32 in natural size: Four spatula sounds 25—28; in 25 and 26 is a bit of the spatula broken off, in 27 and 28 the sound parts. One very elegant sound knob (29). A broken sharp spoon (30). A small sewing needle, round in section (31). — Besides was a bundle (32) of the following articles in bronze: In an open elastic »key-ring« are put eight closed rings one of which carries two tools — a) tweezers, probably for epilation and b) stiletto, which has probably served to several purposes such as undoing seams, loosening knots etc.

I have further acquired the following pieces represented on Pl. IV, 33—35 in natural size:

A *bronze tube* (33) of 2 millimeter diameter, in which I found inserted a sound with an small oval oblique spatula in the upper end; the lower end was broken. If the latter end has been sharply pointed the instrument may have been a trocar e. g. for puncturing hydrocele. Still it must be remarked, that the supposed stiletto was not fixed by oxydation in the tube, and may have been placed there afterwards. The tube is possibly a fragment of a catheter for the infantile urethra.

A bronze *balance lever* with two *equal arms* and index (34 a); the crook of suspension and the two scales are missing. Each arm has a joint by which more then $^2/_3$ of its length may be placed parallel to the index (34 b). In this way the balance might easily be reduced in size for being put into a case for travelling purposes. The balance was only fitted for light weights e. g. for very effective drugs; a similar one — without joints — was found besides a steelyard among the instruments of the above named Roman oculist from Rheims But as our balance surely has been an instrument for travelling purposes it may more probably have served as a *money balance*, as the ancient gold coins very often were debased.

A knife handle of silver[1] is very interesting both in the ornaments and in the inscriptions (Pl. IV, 35 a, b and c in natural size, a^2 and b^2 in double size). The knife blade, which has been inserted in the split 35 c, was certainly made of steel and long ago destroyed by rust. The handle was cast: a small congealed projecting metal drop on one side (35 b and b^2) has corresponded with the funnel of the mould. the indistinctness of the ornaments in the upper third of the same side seems due to an unsuccessful cast work. The ornaments and letters are depressed.

On one side the border drawings are continual single spirals (a and a^2), on the other side a serrated pattern (b and b^2). These border decorations are by a line separated from two central fields, of which the upper one shows hunting scenery with barking dogs; on a and a^2 is seen an animal (wild boar?), who faces his pursuers; on b and b^2 only two animals are distinct, and the rest seems to have been unsuccessfully cast.

The fields near the blade have Greek inscriptions, which Professor S. Eitrem of Kristiania has been kind enough to interprete.

On one side of the handle is written:

ΘΕΣΜΕΚΛΕΠΤΑ

— *θές με, κλέπτα*

»Put me down again, you thief!«; in other words: »I am not for you«.

On the other side of the handle (35 b and b^2) we read:

ΚΥΡΙΝΕΧΩ

— *κύρι(ο)ν ἔχω*

»I have (already) a master: and I do not need a new one.

The inscription has probably been a well known formula applied on such objects. The artist — who perhaps was not a Greek — has copied the formula but has omitted the O in *KYPION*. Omega is engraved as a minuscule, the other letters are all majuscules.

Judging from the form of the letters, especially the short cross stripe at the end of each character the handle originates from the 3rd century of the Christian era — or later.

Regarding the use of the knife the animal pictures might indicate a hunting knife; but for that use the handle is too slender. It might be fit for a table knife or a surgical scalpel. The upper end of the ancient scalpel

[1] I have submitted a chip of the knob of the upper end for quantitative analysis to professor J. Sebelien who has kindly given me the result: Silver 80.22 %, Lead 0.90 %, Copper 7.80 %, Iron 1.01 %, Gold 0.52 %, Tin traces.

handles have often — but not always — the form of a myrtle-leaf intended for stump dissection. Silver was not the common material for a surgical instrument handle but was often used as damaskeened ornaments in the bronze. But that silver also was used alone we know from the mocking speech of Lukianos on surgeons »who tried to overawe the public by their instruments of gold and silver, which they did not understand the use of«.

I will now consider some instruments with more detail as to their probable use.

The instruments Pl. II 7 and 8 were not originally made for surgical use: a bronze handle has on either end a two pronged fork with blunt nearly joined points. At first I did not see what could have been the use of these two instruments; but Dr. Med. Fredrik Grön told me that in 1913 he saw a similar instrument in the greatest archæological museum of France at Saint-Germain-en-Laye, in the celebrated collection of surgical instruments after the above (p. 7 foot note) mentioned Roman oculist Cajus Firmius Severus, who lived in Rheims at the time of Marc Aurel. This bifurcated instrument, which had not attracted my attention when I saw the collection 19 years ago, was labelled »une navette à filocher«[1] = a net shuttle. In a very interesting and beautifully illustrated book by the English collector Dr. J. S. Milne of Hartlepool »Surgical Instruments in Greek and Roman Times« (Oxford 1907) there is an illustration of a similar instrument which the author, because it resembles the Roman netting needle, believes has come by a fallacy among his surgical bifurcated probes. »In its *typical* shape the *Roman netting needle* has the *forks in two plans at right angles to each other*«. This is even the case with Pl. II, 8 and nearly with 7 where the angles are 70^0 and 110^0. The instrument may have been called by the Romans »*furca* retiaria«, because by the Greeks it was certainly called *χήλη* or *χηλῶτιον* — but it had probably been used also by other people round the Mediterrean since times immemorial; fishing nets are mentioned by Homer both in the Odyssey and in the Iliad. — I showed the instruments to an expert in netbinding; he found them very practical and on my question about the reason of the position of the plans of the forks, and the crossing of the points (see Pl. II, 8, beneath) he answered

[1] It is however possible that this netting needle has only come into the same case as the surgical instruments from Rheims by chance; neither by Deneffe nor by Milne is any such tool mentioned in their description. — That both the two Ustinov netting needles and those of Milne may have been admitted by chance or by misunderstanding cannot of course be denied; but as will be seen from the folloving statement it is far more likely that the surgeons themselves have deliberately chosen these useful tools for their work.

that both facilitated the winding of the yarn. The netting needles used by our fishermen when making or mending their nets themselves are of the same principle: a double wooden fork, only the prongs join only in the end, which is to go first through the meshes. Besides Dr. Med. F. G. Gade told my after my demonstration of old and modern fishing net needles, that the old instrument exists this very day in the form of the »filet needle« for the French net-work embroidery; in figure 2 this instrument is seen working.

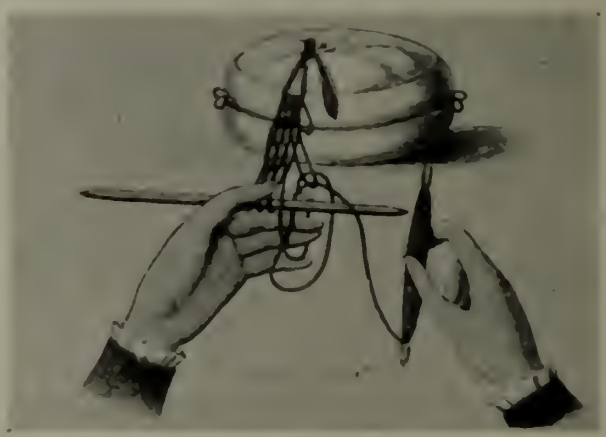


Fig. 2.
Net-work embroidery with the »filet needle«, on which the thread is wound.

In fig. 3 the two Roman fishing net needles are seen with the yarn wound.

I am sure that the surgeon in Ascalon found the netting needles very convenient for *keeping neatly arranged surgical suture thread.*

Fig. 3.
The netting needles Pl. II, 7 and 8 on a reduced scale with the thread wound.

The instrument of the Mediterrean countries followed the Romans to Gaul and Britain where the surgeons were of the same opinion as their colleague in Palestine.

I will now direct your attention closer to the instrument Pl II, 5 the upper end of which is a sharp spoon 12 mm wide 6 mm deep; it has probably been used among other things to remove slap wound granulations. Above all, however, along the length of the sound from the base of the spoon downwards to the conic point of the sound there runs a very fine measure scale of transversal filed lines, which are partly more or less veiled by the layer of patina, and which in order to get it distinctly on the cliché, I have made distinct with zinc white. In the middle part, which is best preserved, are 24 division lines on a length of 24 mm; the division is not, however, absolutely regular, for within the same part are 18 division lines on a length of 18.5 mm. In the latter case it might be thought that a division of the attic *δάκτυλος* was meant, which, however, ought to be exactly 19 mm. The division of twelve lends more probability to the supposition that it is the Roman »uncia« = $^1/_{12}$ »pes« = 24 mm which has been the point of departure. Whether the former or the latter point of view is chosen, the surgeon in Ascalon has *practically used a millimeter scale* at least one millennium and a half before the invention of the metrical system during the great French Revolution.

This instrument like the other sounds has among other things been used to localize foreign bodies in fistulæ and deep wounds; to-day we have the X-ray photography.

As for sounds and spatula sounds it must be remembered that they were not always medical instruments. They were also used by painters in *preparing colours* and by ladies in *cosmetic manipulations*. Instrument Pl. II, 1 was in my opinion very well adapted to the blackening of grey or defective eyebrows; a thing which to this day is much used in the East, also by men as it is considered a remedy to prevent eye diseases. The physicians often used the spatula sound as a *pharmaceutical* instrument at the preparation of innumerable mixtures of remedies among which »collyria« for treating eye diseases played a great part. Many of these collyria contained copper compounds and were certainly fit for the treatment of *trachoma* the »Egyptian eye disease« which then as now made severe ravages also in Syria and Palestine. The end of the sound was used then as now (see Pl. III, 15 and 22) to put ointments into the palpebral fissure and the Syrian surgeons have certainly often used the sound Pl. I, 25, 26, Pl. II, 1, 2, 3 and most of the sounds in Pl. III in this way.

Looking at the sounds with a conic point (Pl. I, 29, II, 5 and Pl. III, 19—20) a surgeon of the present day must think of the possibility that they have been used in the treatment of gonorrhoic strictures of the urethra.

Dr. Johan Bergman supposes in his interesting book on Pompeji (Stockholm 1915, p. 156) that the surgeons of the town must have had plenty to do on the domain of genital diseases; gonorrhoea was sure to thrive in the great number of brothels (Dr. Mygind). In the establishment of this kind close to the barracks of the gladiators is written on a wall: »Victorum victrix«. I will not assert that the meaning of the inscription has been the one I here put in it: that the victors, at any rate, might meet a worse treatment in this place than in the arena. *Heliodoros* who was surgeon in Rome at the time of Trajan and is mentioned in Juvenal's sixth satire (VI, 369 to 372) is said to have removed fleshlike growths from the urethra and then introduced bronze *tubes* (enveloped in a paper cover soaked and shaped and then dried) in order to prevent the growing together; on the fourth day he changed with tubes of tin or lead. But he does not seem to have known the cause: gonorrhoea, nor the real character of the obstacle: stricture formed by scars; bougies as we have them, *solide sounds* for the dilatation of strictures were *out of the question* (Milne). Strictures by scars in the urethra were not discovered till the introduction into science of the pathologic anatomy (Morgagni's: »De sedibus et causis morborum per anatomiam indagatis« 1761). A few years later clinic diagnosis and treatment began with John Hunter.

The observations of Heliodoros soon seem to have been forgotten. Paullos Aiginetes (7th century) and Abulqāsim (11th century) mention no other causes of urinal retention than calculi in the neck of the bladder or urethra.

Many of the sounds may have been used at the membrane punction in the operation which forensic medicine of to-day calls criminal abortion. The operation was used to a great extent by the Greeks as well as the Romans from the very same motives which twenty years ago Emile Zola complained in his novel »Fécondité«. This was not then considered as a crime — partly out of the theory that the life of the fetus only began with the birth. Tertullian spoke violently against this in his sermon »De anima« and asserts referring to the operations performed in such cases that the life of the fetus begins in utero; he mentions in his sermon no less than four instruments used by the surgeons for the mutilation of the fetus.

I will now enter more fully upon the consideration of one of the instruments which is of more than usual interest: Pl. III, 23. Though the active part of it was broken and was not found I believe that it is an *Arabic eye instrument for depression of cataract*, an operation which was practically the only one known till in 1752 Daviel discovered the

principle of the best operation: the removal of the cataracted lens. The depression of cataract was performed by puncturing the membranes outside the cornea with the triangular sharp point of a *strong* bronze needle fitted with a handle; the point of the needle was brought up to the upper edge of the lens, which was then forced down to the bottom of the eye; the first step the puncture of the membranes outside the cornea was often made with the point of a lancet.

How can I make it likely that the broken instrument 23 has been a depression needle? It cannot be proved, as the sharp part of the instrument is wanting; but I have the following facts to support my opinion:

1) The diameter of the square handle 4 mm is about the same as in the ophtalmic instruments of the present day; I do not however lay grea stress upon this point.

2) The proportion between handle and shaft (Fig. 5) corresponds with some Arabian diagram pictures (Fig. 4) of depression needles in Abulqāsim's textbook of surgery (11th century); in spite of the prohibition of the Koran against images, the work is illustrated in the oldest manuscripts perhaps by Christian copyists who have seen the Arabian instruments.

In the Latin translations of Abulqāsim (younger manuscripts and incunabel prints) the illustrations become more and more fantastic, while they are arbitrarily simplified in Leclerc's French translation, whose drawings were lent by Gurlt.

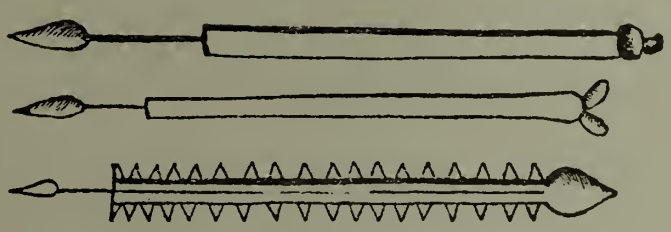


Fig. 4.

The picture of the Channing Abulqāsim edition 1778 of three Arabic couching needles for cataract from MS. Huntingdoniensis, number 156, Bodleian Library in Oxford after Karl Sudhoff.

Fig. 5.

The instrument Pl. II, 23 photographed in such a position that one of the four edges is seen along the middle axis while the sawtoothed outlines of the upper and lover edge are seen in profile.

From fig. 5 will be seen the great resemblance between our number 23 and the lowest picture in fig. 4 from the Arabian MS. in Oxford. This fact makes me agree with Mr. Hirschberg that the sawtoothed outlines of the latter are only an unsuccesful drawing of the decoration of the handle. The same is the case with the reproduction of the stem of the instruments in the two lower pictures in fig. 4 as a thin line; even made of steel they would have been too slender. Made of bronze the stem ought like ours, be 2 mm. The ancient authors say expressely that the cataract couching needle (always bronze) must be *strong*; for this reason the puncture with the cataract needle itself through the membranes of the eye was often difficult, and therefore performed by the Arabs with a scalpel point as the Mohammedan cataract couchers still do in India today (R. H. Elliot).

3) One end of the handle is provided with a knob of 2 mm diameter, and seems likely to be made for a preparatory act in the depression such as it is described by Antyllos, by Paulos Aginetes and by many Arabian surgeons. Local anæsthetics were not known, the operation was painful, the eye made an escaping movement upwards by which the surgeon might risk making a wrong puncture. In order to prevent this accident, both Greek and Arabian authors advised the operator first *to make with the knob of the handle a dent* in the surface of the eye where the puncture was to be made; then turn the instrument and make the puncture exactly in the dent. According to Hirschberg, Salah Ad-Din advised first to dip the knob into an antimonial paint by which the dent became a black spot.

According to Mr. Sudhoff similar end knobs as those seen in fig. 4 and fig. 5 may be found as decorations on pictures of Arabic tooth instruments in the Latin incunabel editions; but none of those drawn in his work, have »sawtoothed« outlines and in the only one which could be considered (Sudhoff fig. 32) only the handle is of bronze in which a steel instrument is placed. Our instrument, like all ancient cataract couching needles, is wholly of bronze.

Arabic surgical instruments do not seem to exist in European museums. At any rate no special journal of the history of medicine contains anything about this; and illustrated accounts of medical history contain only diagrams from the above mentioned Mediæval manuscripts. It is possible that the very durable old bronze instruments are handed down to the next generations and are used to this very day. At any rate medical textbooks from the middle ages (in printed copies) are still in use by such Arabian physicians as have not acquired modern medical education from the French in Algiers and Beirut and from the English in Cairo. Of the Arabian instruments in Pl. III, I believe 11 and 23 to be the rarest.

The Greco-Roman instruments which I have shown on the contrary can no longer be called great curiosities. Besides at Herculanum and Pompeji there have later been found many similar ones in Switzerland, France and England, as well as in the Rhine and Danube countries. The »millimeter scale« must however by very rare. I have not found a single measure scale, still less so any with so fine divisions, on the hundreds of illustrations of Greco-Roman surgical instruments in Deneffe, Gurlt, Milne and Védrènes, which I have examined. It is true, such a one on account of the patina layer might easily escape attention.

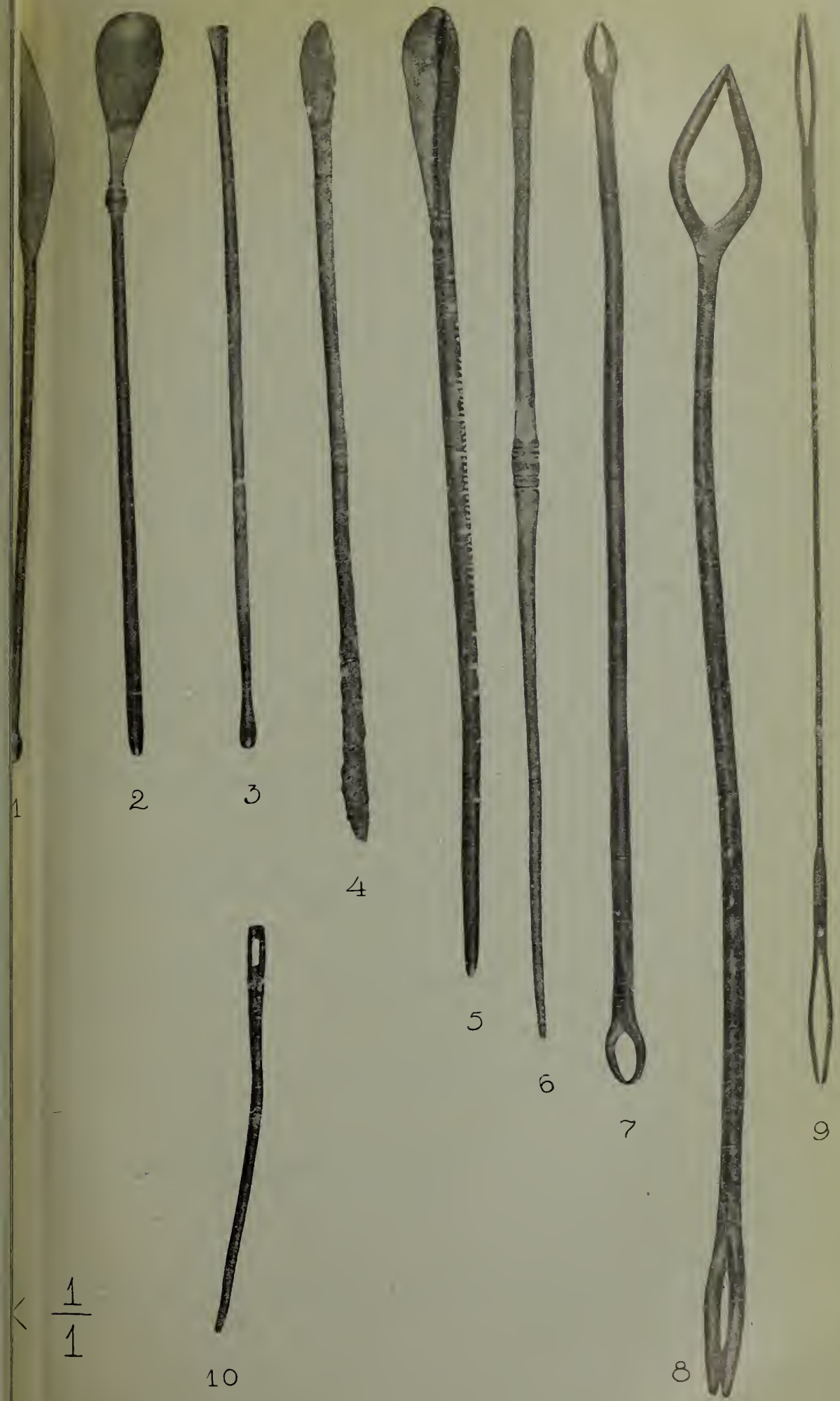
My explanation of the repeated appearance of the Roman netting needle among the Greco-Roman surgical instruments may, I believe, be accepted as a slight increase in our knowledge of medical archæology.

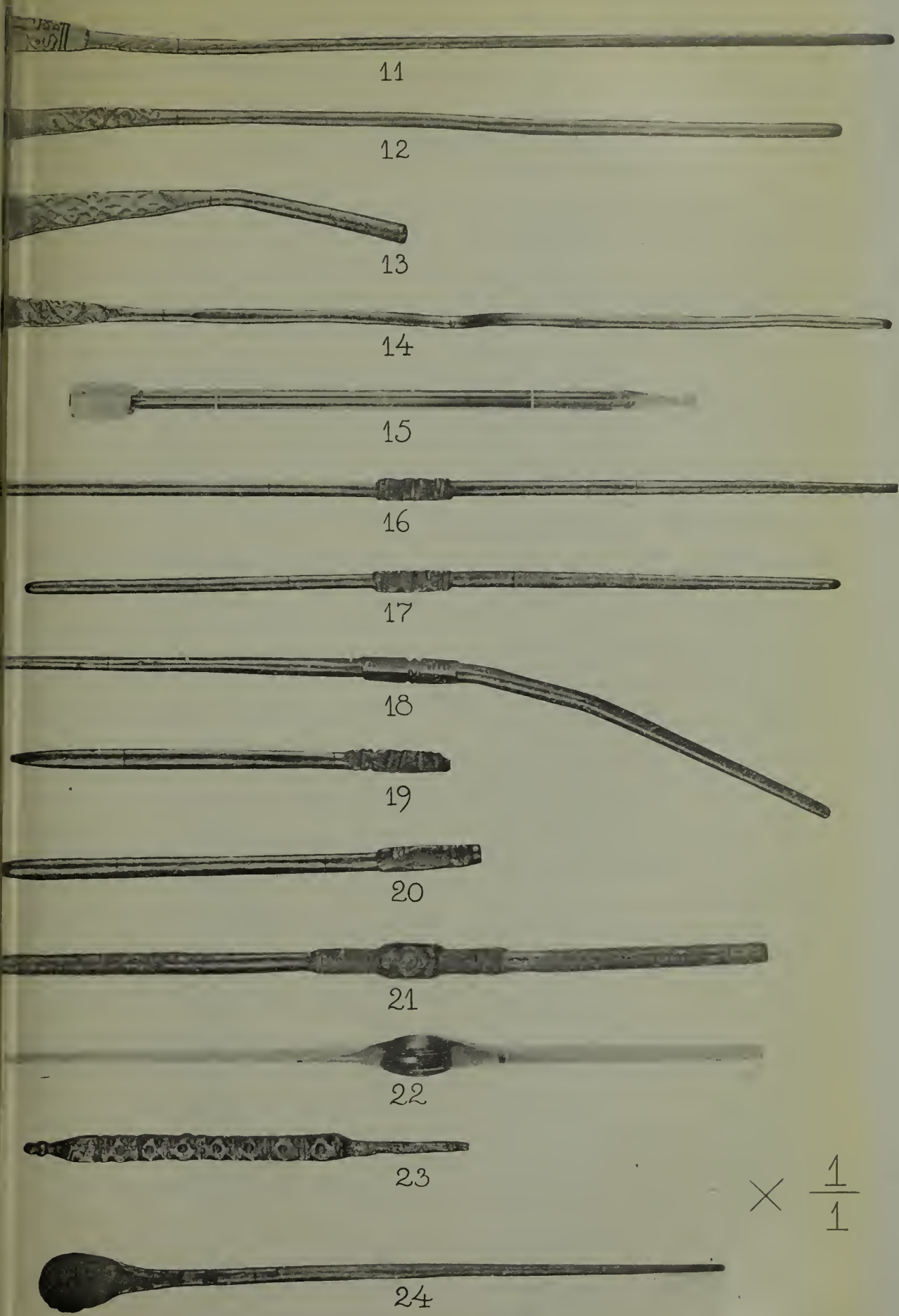
LITERATURE.

1. Abulcasis. La chirurgie d'Abulcasis. Traduite par le Docteur Lucien Leclerc. Paris 1861
2. Johan Bergman. Pompeji. 2 Uppl. Stockholm 1915
3. Karl Baedeker. Palestine et Syrie. 4e Ed. Leipzig 1912
4. Hugo Blümner. Technologie und Terminologie der Gewerbe und Künste bei Griechen und Römern. Leipzig 1912
5. Celsus. Traité de Médecine de A. C. Celse. Traduite par le Dr. A. Védrènes. Paris 1876
6. Ch. Daremberg, Edm. Saglio et Edm. Pottier. Dictionnaire des Antiquités Grecques et Romaines. T. I, II et IV. Paris 1877—1911
7. Deneffe. Etude sur la trousse d'un chirurgien Gallo-Romain du IIIe siècle. 1893. H. Caals, Editeur, Anvers
8. Deneffe. Les instruments Gallo-Romains au IIIe siècle. 1890. H. Caals, Libraire, Anvers.
9. R. H. Elliot. The Indian Opera and its Influence on the Art of Singing. 1917. H. K. Lewis & Co. London.
10. E. Gurlt. Geschichte der Chirurgie. B. I. Berlin 1898
11. Jul. Hirschberg. Geschichte der Augenheilkunde. In Graefe-Saemisch. Handbuch der gesammten Augenheilkunde, 2te Aufl. B. XII, 2. 1899. T. XIII. 1908. Leipzig
12. E. Lüddeckens. Die Zahlzeichen der alten Kulturvölker. 1918. B. G. Teubner Leipzig.
13. J. S. Milne. Surgical instruments in Greek and Roman times. Oxford. 1907.
14. Holger Mygind. Hygiejnske Forhold i Oldtidens Pompeji. K. Seidlaven 1918
15. Karl Sudhoff. Beiträge zur Geschichte der Chirurgie im Mittelalter. Zweiter Teil 1918. Johann Ambrosius Barth, Leipzig

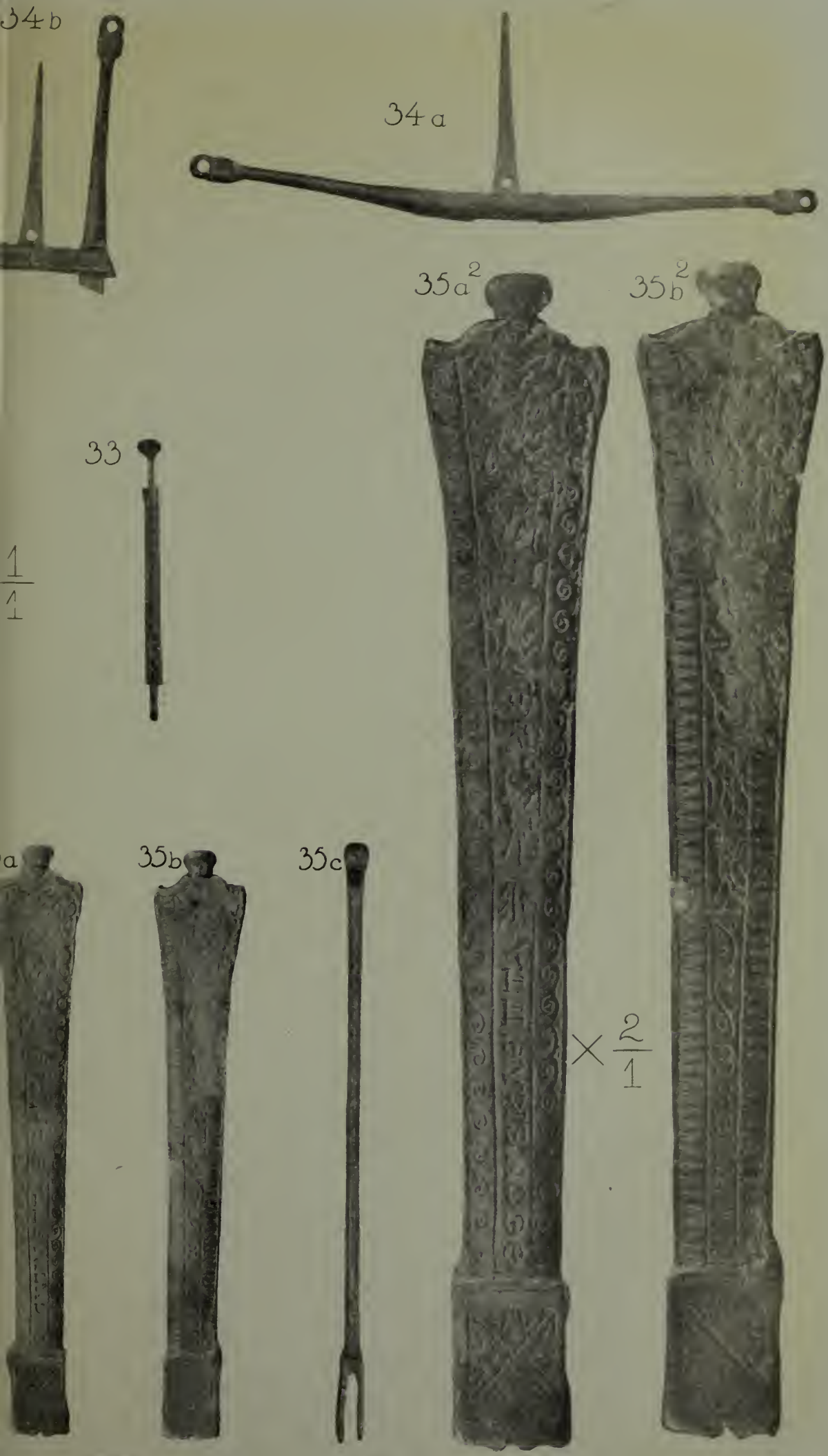
Printed 8 December 1919

D


1
2
3
4
5
6
7
8
9
10
1/1



× 1/1


34 b
34 a
35 a 2
35 b 2
33
1/1
a
35 b
35 c
× 2/1